INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

LCS-C SERIES

Electronic Services - Los Angeles
M13448X

LAMBDA

LAMBDA ELECTRONICS CORP.–MELVILLE, L. I., N. Y.

INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

LCS-C SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics Corp. All information contained herein applies to all LCS-C models unless otherwise specified.

LAMBDA ELECTRONICS CORP. MELVILLE, L.I., N.Y.
MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

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SPECIFICATIONS AND FEATURES

Specifications apply for all models.

DC OUTPUT - Voltage regulated for line and load.

TABLE I

VOLTAGE AND CURRENT RANGES

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE				INPUT POWER (Watts*)
		40°C	50°C	60°C	71°C	
LCS-C-20	20 ± 5%	4.2	4.0	3.5	3.0	190
LCS-C-24	24 ± 5%	3.6	3.4	3.0	2.5	190
LCS-C-28	28 ± 5%	3.0	2.7	2.6	2.2	190
LCS-C-36	36 ± 5%	2.3	2.2	2.1	1.6	190
LCS-C-48	48 ± 5%	1.8	1.7	1.6	1.3	190
LCS-C-100	100 ± 5%	0.65	0.65	0.65	0.65	120
LCS-C-120	120 ± 5%	0.55	0.55	0.55	0.55	120
LCS-C-150	150 ± 5%	0.42	0.42	0.42	0.42	120
LCS-C-01	0-7	4.5	4.1	3.8	3.3	110
LCS-C-02	0-18	2.3	2.1	1.9	1.6	95
LCS-C-03	0-32	1.6	1.5	1.4	1.2	110
LCS-C-04	0-60	0.85	0.8	0.74	0.65	95
LCS-C-05	0-120	0.33	0.33	0.33	0.33	65

*With output loaded to full 40°C rating and input voltage 132 volts AC, 60 Hz.

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT

Regulation (line).....0.01 percent plus 1.0 millivolt for input variations from 105-132 or 132-105 volts AC.

Regulation (load).....0.01 percent plus 1.0 millivolt for load variations from no load to full load or full load to no load.

Remote Programming

External Resistor.....Nominal 1000 ohms/volt output

Programming Voltage...One-to-one voltage change

Ripple and Noise.....250 microvolts rms; 1 millivolt peak to peak with 57-63 Hz input

Temperature Coefficient....Output change in voltage (0.01% + 0.3% mv) /°C using an external programming resistor, less than (0.015% + 0.3% mv) /°C with internal resistor

Remote Sensing.....Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation

AC INPUT - 105-132 or 205-265 ("V" option) volts AC at 47-440 Hz. For input power see table I. Ratings apply for 57-63 Hz; at 47-57 Hz derate current rating 10% for each ambient temperature given in table I. For 63-440 Hz input, consult factory.

OVERLOAD PROTECTION

Thermal.....Thermostat, resets automatically when over temperature condition is eliminated

Electrical

External.....Automatic electronic current limiting circuit, limits output current to a preset value less than 110% of 40°C current rating. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

Internal.....Fuse F1 provides protection against internal circuit failure.

INPUT AND OUTPUT CONNECTIONS - Terminal block on rear of chassis.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE - Continuous duty from -20°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE - (non-operating) -55°C to 85°C

CONTROLS

DC output control.....Voltage adjust control permits adjustment of DC output voltage via access hole located in nameplate

PHYSICAL DATA

Size.....3-3/16" x 4-15/16" x 9-3/8"

Weight.....10 lbs. net; 11 lbs. shipping wt.

Finish.....Grey, FED STD 595 No. 26081

MOUNTING - Three surfaces, each with tapped mounting holes, can be utilized for mounting this unit. Refer to figure 12 for mounting details.

MODEL OPTIONS

"V" Option.....Standard LCS-C power supplies can be obtained for 205-265 VAC Hz input. At 47-57 Hz or 63-440 Hz input, consult factory for details of operation

"S" Option.....All fixed voltage LCS-C power supplies must be specified with the "S" option when used with the System Power Sequencer. On units with "S" option, resistor R20 is jumped, see schematic diagram.

ACCESSORIES

Rack Adapters.....Rack adapters LRA-4, LRA-6, LRA-8, LRA-10, and LRA-11 used for ruggedized mounting with or without chassis slides are available as well as rack adapters LRA-3 and LRA-5, which are used for simple rack installations where chassis slides are not required.

Overvoltage Protector.....Externally mounted, Overvoltage Protector LM-OV-3 is available for use with Lambda LCS-C-20 through LCS-C-48 power supplies. On models LCS-C-01 through LCS-C-04, use overvoltage protectors LH-OV-4, LH-OV-5, & LH-OV-6.

Control Panel.....All LCS-C power supplies may be obtained with a Systems Power Control Panel SP-3 or SP-5. This unit, mounted on rack adapters LRA-8, or as applicable, LRA-10 or LRA-11, and used with a Systems Cable or Auxiliary Cable, provides an on-off switch, voltage control and pilot light

Metering Panel.....A Systems Metering Panel SMP-3 or SMP-5 may be used in conjunction with the LCS-C power supplies. The panel mounted in rack adapters LRA-8 or as applicable LRA-10, LRA-11, and used with a Systems Cable, contains a voltmeter and an ammeter, each with three ranges and a push button selector switch. The selector switch allows monitoring of the voltage and current of any of up to 8 outputs.

THEORY OF OPERATION

GENERAL

The Lambda power supply consists of an AC input circuit and transformer; a bias supply consisting of an auxiliary rectifier, and preregulator*; a main regulator circuit consisting of the main rectifier and filter, a series regulator, emitter follower driver, a current comparator*, a voltage comparator*, an amplifier*, current and voltage sensing networks and a voltage reference circuit*.

* This circuit element is part of integrated circuit (IC1) in the supply.

The circuit arrangement is shown in block diagram form, Figure10. The circuitry is discussed with reference to the block diagram and the schematic diagram.

FUNCTIONAL DESCRIPTION

Single phase input power is applied to transformer T1 through the input circuit which contains a thermostat to protect the supply against over heating.

The main rectifier, a full wave rectifier, provides the power which is filtered by capacitor C6 and, as applicable C3, and then regulated via a series regulator and delivered to the output. Half-wave auxiliary rectifier CR1 provides voltage filtered by capacitor C1 for the preregulator located in IC1. The reference element, powered by the preregulator, provides a reference voltage for the current comparator and the voltage comparator.

Constant voltage circuit operation is determined by changes in the load which cause a change in one input to the voltage comparator. A second input to comparator is a reference voltage that is developed by a constant current of 1 milliampere flowing in divider element R8. The comparator compares the output voltage change with the reference voltage resulting in an error signal at the output of the comparator.

The error signal from the comparator is then current amplified by drivers Q1 and Q2. The amplified signal from the drivers controls the voltage across the series regulators Q3, Q4, and Q7, which function as the active regulating elements in the supply.

* Current limit circuit operation for models LCS-C-20 through LCS-C-150 is determined by changes in the load. The current comparator samples load current through current sensing resistor R7. When the voltage drop across R7 increases to the preset voltage reference is determined by R6, R9, and R13, the current comparator conducts. Thus, when the output current rating of the unit is exceeded, the current comparator conducts, decreasing the current through drivers Q1 and Q2, resulting in an increase of voltage across the series regulator and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by fixed resistors R6, R7, R9 and variable resistor R13.

When operating conditions approach short circuit, the output voltage decreases. Since the voltage determined by R13 is proportional to the output voltage, when the output voltage decreases, the amplifier is biased into turn on at lower and lower load currents until output voltage decreases to zero and current decreases to a predetermined low value.

* The following theory applies to models LCS-C-01 through LCS-C-05.

Current limit circuit operation is determined by changes in the load. When load current increases above the rated current value, the voltage drop across current limit potentiometer R13 increases causing the amplifier to turn on. With the amplifier conducting the current to driver Q1 and Q2, decreases, limiting the base current to series regulators Q3 and Q4 which results in an increase of voltage across the series regulators and a decrease of the output voltage, effectively limiting the output current to a safe value. The current limit value is determined by the factory setting of current limit potentiometer R13.

When operating conditions reach short circuit, the output voltage value decreases to zero and the current remains at the current limit value.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature and will remain limited to less than 110% of 40°C rating.

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminal block on the rear of the supply. Apply input power to terminals 1 and 2; always connect the ungrounded (hot) lead to terminal 1.

The supply positive terminal is brought out to terminal 6. The supply negative terminal is brought out to terminal 5. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks and measurements of current or voltage at the rear output terminals. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections For Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Two-Wire Connection, Figure 3. The two-wire connection, with local sensing, is the connection suitable for applications with relatively constant load.

Four-Wire Connection, Figure 4. The four-wire connection with remote sensing, provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at 1000 ohms/volt and a shorting-type switch as shown in Figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation. Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Fig. 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply if the output voltage control of the programmed supply is set to minimum output voltage.

The programming supply must have a reverse current capability of 1.5 ma minimum.

Alternatively, when supplies with less than 1.5 ma reverse current capability are used, a resistor capable of drawing 1.5 ma at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation

The voltage capability of LCS-C power supplies can be extended by series operation. A maximum of 300 volts can be connected between either the +DC or -DC terminal and chassis ground with a maximum voltage capability of 300 volts possible for model LCS-C-150.

Figure 7, and as applicable, 7A, shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

Figure 7 applies only to the LCS-C-01 through LCS-C-05 power supplies. If a common load is used, the maximum current rating of the unit with the lower current rating must not be exceeded.

Figure 7A shows the series connection applicable to the LCS-C-20 through LCS-C-150 power supplies. A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7A. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of "Specifications and Features" for power supply current and voltage ratings.

Connections For Parallel Operation (Applicable only to LCS-C-01 - LCS-C-05)

The current capability of LCS-C power supplies can be extended by parallel operation of LCS-C power supplies of equal* voltage capacities.

Units "M" and "S" are shown connected for parallel operation in figures 8 and 9. One power supply designated the "M" unit controls its own output as well as the output of the second power supply, designated the "S" unit.

* For applications using supplies of unequal voltage ratings, consult factory for details of operation.

Unit S operates to regulate its current in a ratio to that of the M unit by comparing the current in its internal sampling resistor with that current sampled by the master internal sampling resistor.

CAUTION: Always set "S" unit voltage control to zero (fully CCW) during parallel operation, otherwise excessive current will flow through "M" unit voltage control.

NOTE: In order to maintain regulation specifications on model LCS-C-05, current must never fall below 0.5 ma.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat opens the input circuit only when the temperature of the internal heat sink exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Fuse Shutdown

Fuses will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative. When the LCS-C supply is used with the overvoltage protector option fuse F1 will provide load protection against internal component failure.

MAINTENANCE

GENERAL

This section describes trouble analysis routine, replacement procedures, calibration and test procedures that are useful for servicing the Lambda LCS-C power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check fuse, primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumper and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 11, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an instrument that has a highly limited current capability. Observe proper polarity to avoid error in measurement. The forward transistor resistance is low but never zero; backward resistance is always higher than the forward resistance.

For good transistors, the forward resistance for any junction is <u>always</u> greater than zero.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional defective components could damage the replaced component.

When soldering semi-conductor devices, wherever possible, hold the lead being soldered with a pair of pliers placed between the component and the solder joint to provide an effective heat sink.

> <u>NOTE</u>: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder, it is a good contact. Do not attempt to cover with solder.

2. Voltage measurements can be made from either side of the board. Use a needlepoint probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to the measuring instrument.

3. Wherever possible use a heat sink when soldering transistors.

4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.

5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:

a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.

b) Dip the wick in liquid rosin flux.

c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

TROUBLE CHART

The trouble chart is intended as a guide for locating trouble causes, and is used along with the schematic diagram.

The operating conditions assumed for the trouble chart are as follows:

a) AC power of proper voltage and frequency is preset at input terminals.

b) Either positive or negative terminal is connected to chassis ground.

c) The power supply is connected for constant voltage with local sensing. See schematic; dotted lines indicate jumpers connected for local sensing operation.

TROUBLE SHOOTING CHART

Symptom	Probable Cause	Remedy
1. Zero volts DC output	OUTPUT VOLTAGE control turned fully CCW	Check OUTPUT VOLTAGE control for proper setting & correct as necessary

TROUBLE SHOOTING CHART

Symptom	Probable Cause	Remedy
1.Zero volts DC output	Short circuit across output of supply	Check load & load connections,correct as necessary
	F1 open	Replace F1,if it blows immediately, check shorted diode CR7,transistors Q1, Q2,Q3,Q4 & Q7 & capacitor C7; replace as necessary
	Series regulator section open	Check Q1 & Q2 for open, replace as necessary
	Shorted CR6 or CR7 (as applicable)	Check CR6 or CR7 for open replace as necessary
	Current sensing resistor open	Check R7 for open, R6 for short
	Aux. rectifier CR1 open	Check CR1 for open, replace as necessary
	Open CR8, CR9, or R1	Check & replace as necessary
2.Unable to adjust output voltage	Damaged OUTPUT VOLTAGE control	Check R8 for short and/or open, replace as necessary
3.High ripple at line frequency or twice line frequency & unregulated DC output	Series regulator transistors shorted	Check and replace as necessary; Q1, Q2, Q3, Q4, and Q7
	Defective main rectifier causes ripple at twice line frequency	Check for open and/or short CR2,CR3,CR4 & CR5, or as applicable CR14 and CR15
4.Same as 3,except intermitten	Foreign matter fallen into unit	Check for loose bench hardware & wire clippings that may have fallen through cover
5.High ripple at frequency other than line or twice line frequency	Oscillation due to defective component in filter network	Check for open C7,C2 & check for open and/or short in C11 & R2. Replace defective component
6.Large spikes at output	Capacitor C5, or as applicable, C4 & C14 open	Replace C5 (or C4 and C14)

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 11. Use suggested test equipment or equivalent to obtain accurate results. Refer to Specifications and Features for minimum performance standards.

Set the differential meter, DVM (John Fluke Model 8x1A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-132 or 132-105 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a VTVM, Ballantine 320 or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R13

Whenever Q3, Q4, R6, R7, R9, R11, R13, R21, R37, or IC1 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R13 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating.

1. Remove AC input power to the supply.

2. Break seal on wiper of R13 from resistor housing and turn to full CW position.

3. Operate power supply for constant voltage with local sensing connected as shown in figure 3, with no external load.

4.* Turn voltage adjust control until minimum rated output voltage is obtained.

5.* Apply load so that output current is 110% of 40°C rating for the unit.

6.* Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R13 in CCW direction. Adjust R13 until output ripple increases sharply and oscilloscope pattern changes.

7.* After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R13 to resistor housing.

8.* After sealing, check setting and repeat adjustment procedure if required.

* Perform alternate steps 4A through 9A for adjustment of R13 on models LCS-C-01 - LCS-C-05.

4A. Turn voltage adjust control until rated output is obtained.

5A. Apply load so that output current is 110% of 40°C rating for the unit.

6A. Using an oscilloscope, Tektronix 503 or equivalent, observe unit output voltage while adjusting R13 in a CCW direction. Adjust R13 until output ripple increases sharply and oscilloscope pattern changes.

7A. Place a DC ammeter of appropriate scale across output terminals 4 and 6 of the supply. The meter indication shall be a maximum of 115% of 40°C rating for the unit.

8A. After adjustment is completed, remove AC input power to the supply and use glyptol sealant to seal wiper of R13 to resistor housing.

9A. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.

2. Lambda part number.

3. Description of part together with circuit designation.

4. If part is not an electronic part, or is not listed, provide a description, function, and location of the part.

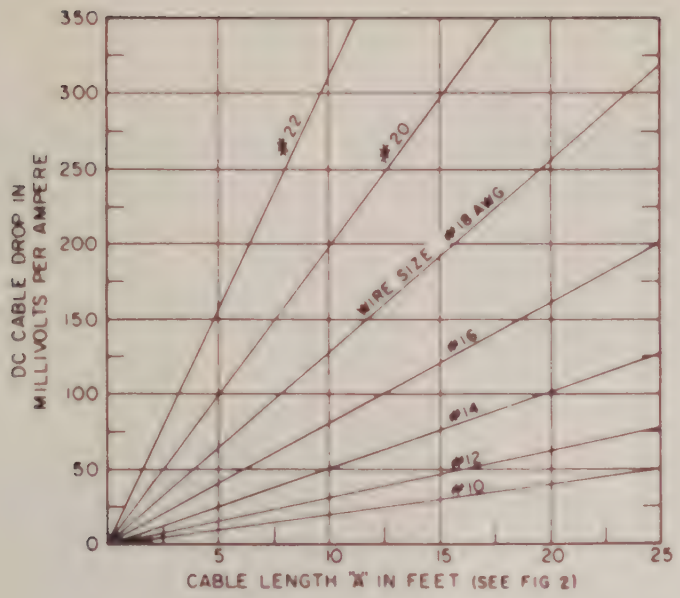


Figure 1. Cable Connection Chart

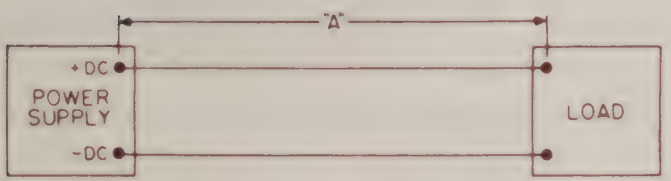
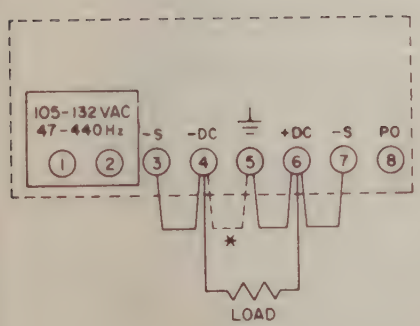
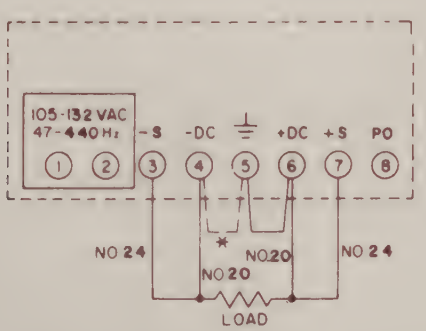


Figure 2. Cable Length "A" in Feet



NOTE.
* FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 6 AND RECONNECT TO TERMINALS 4 AND 5

Figure 3. Two-Wire Connection



NOTE.
* FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 6 AND RECONNECT TO TERMINALS 4 AND 5.

Figure 4. Four-Wire Connection

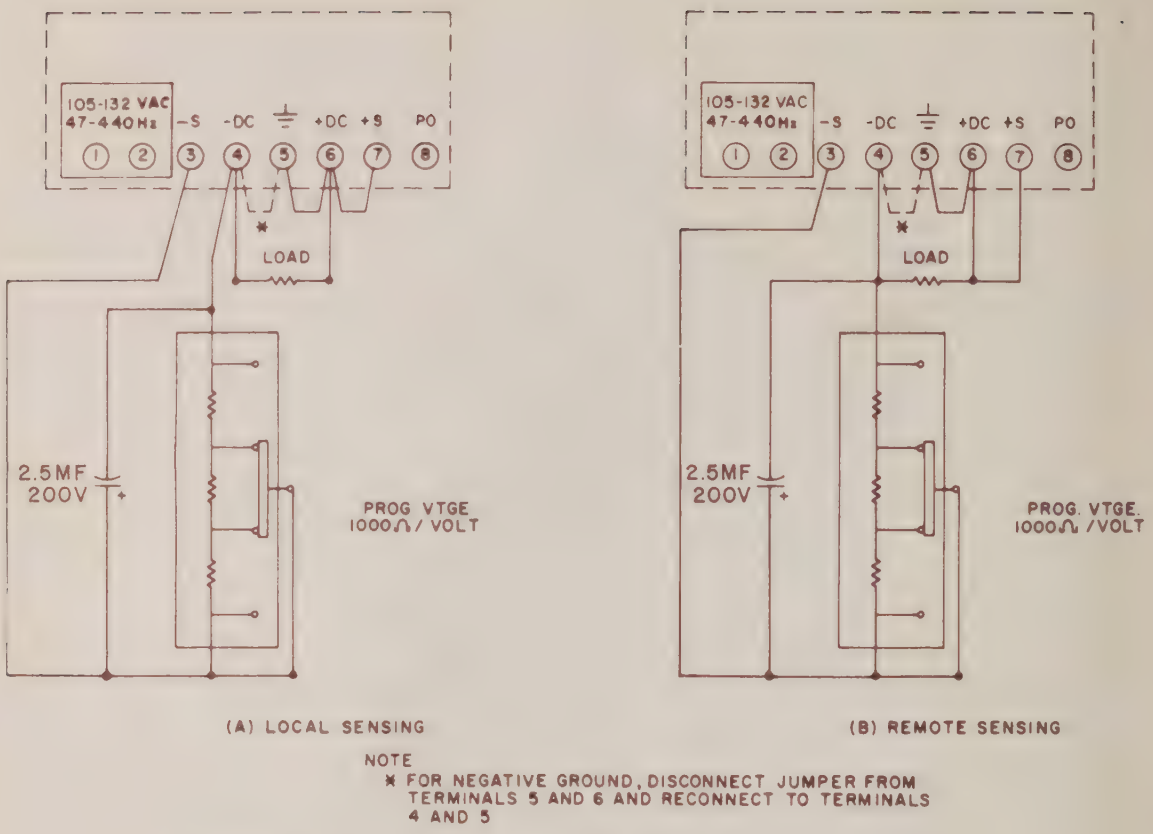


Figure 5. Programmed Voltage, With External Resistor

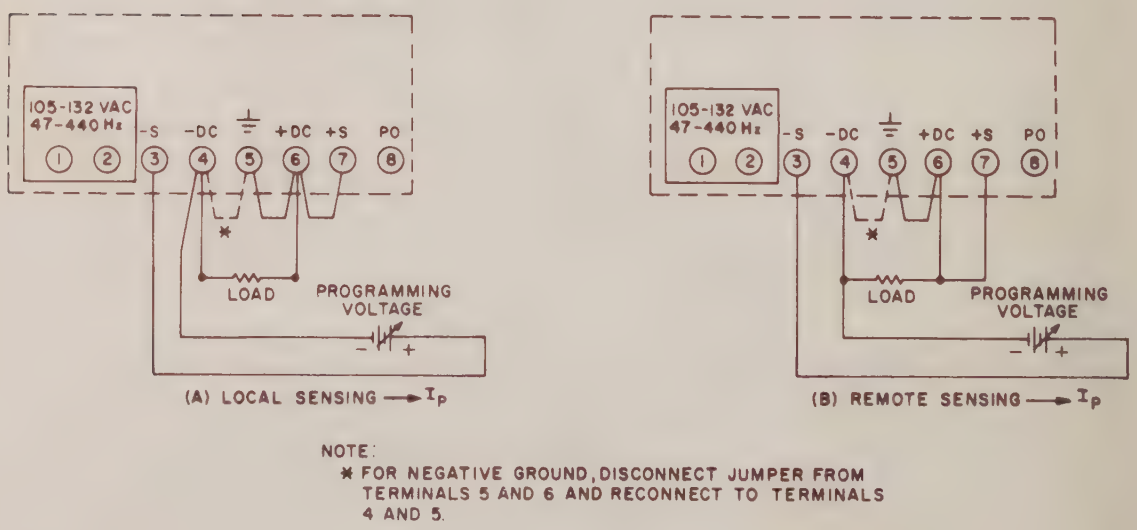
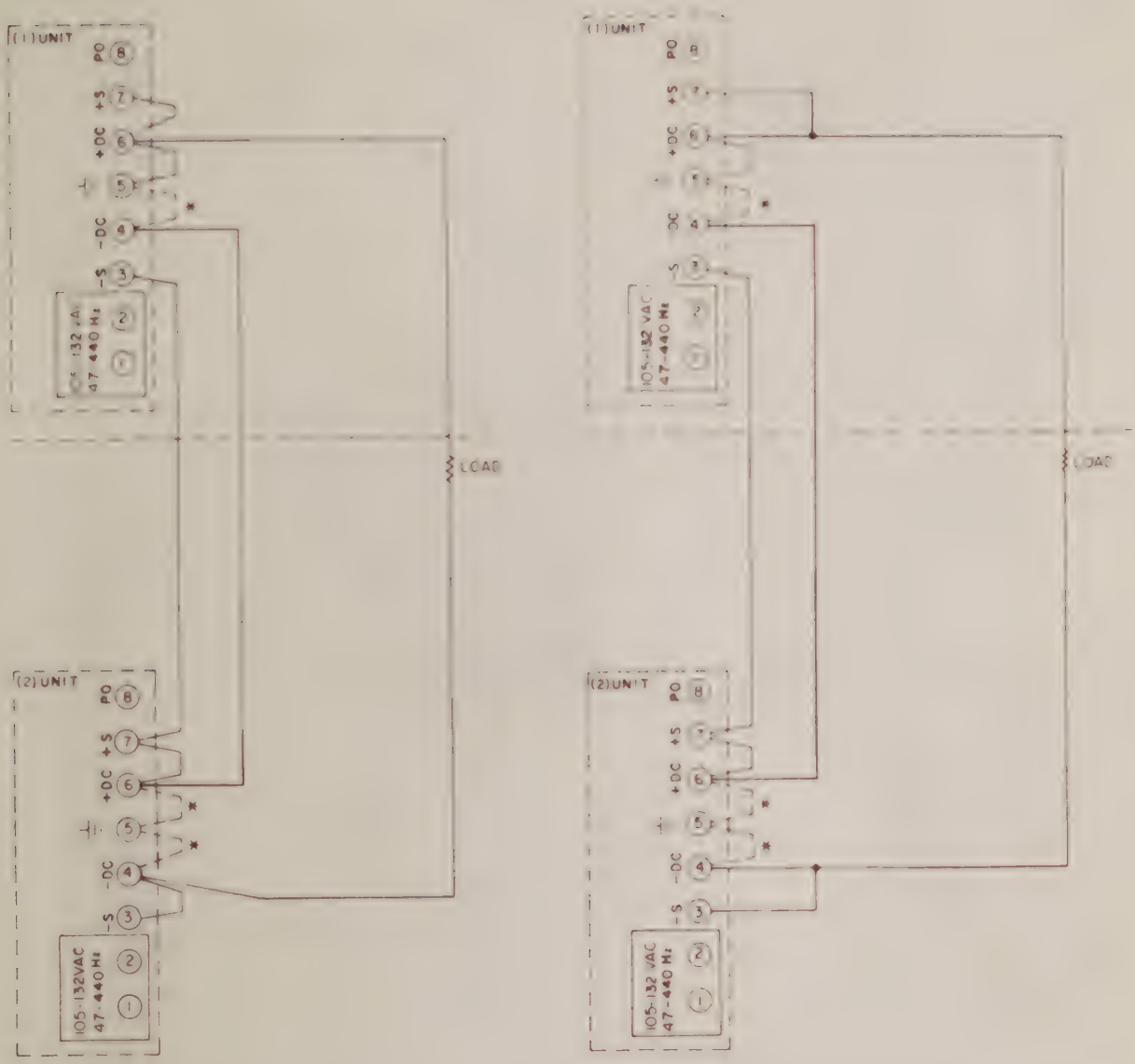


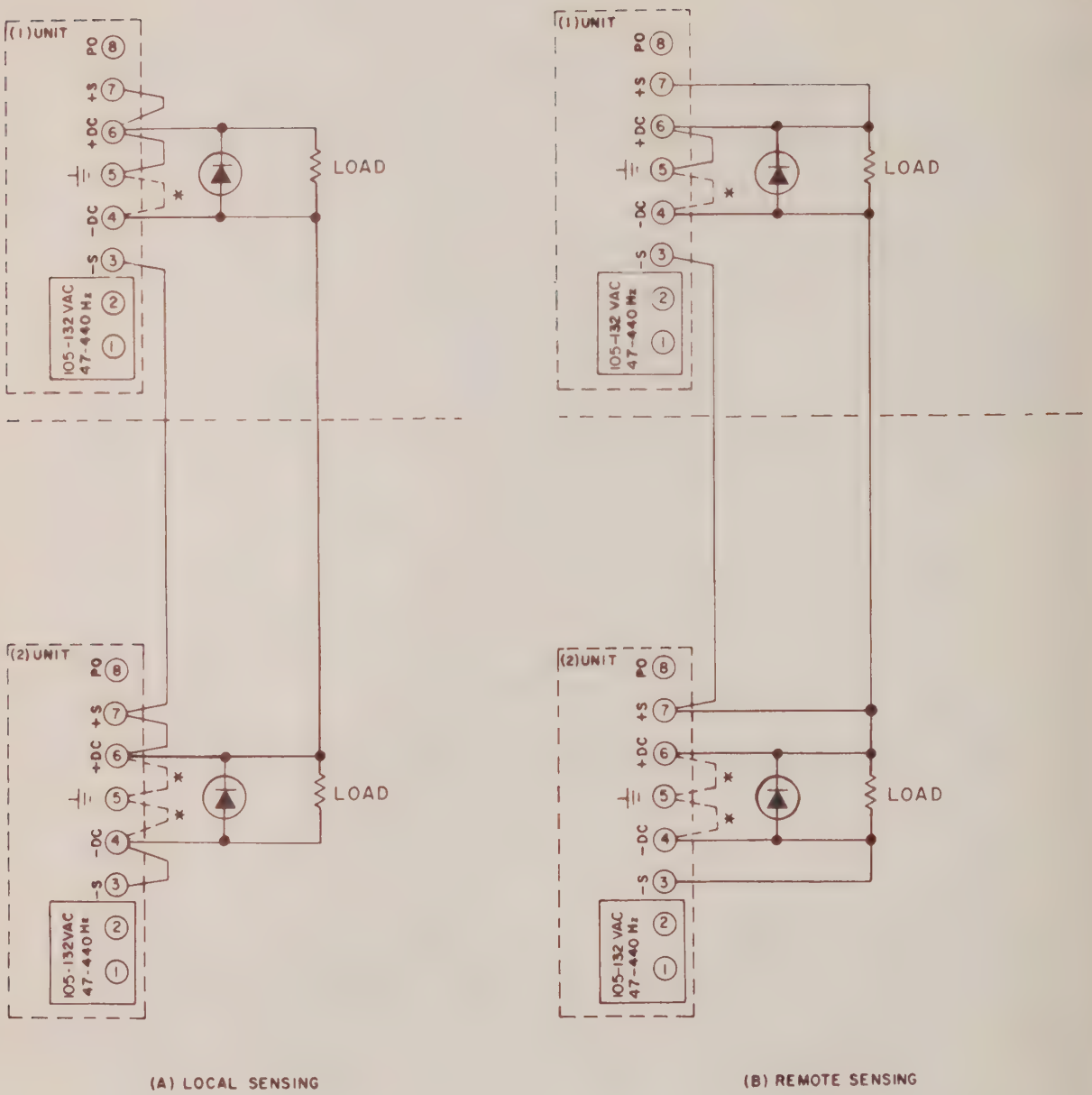
Figure 6. Programmed Voltage, With External Programming Voltage Source



NOTE

* MAKE ONLY ONE GROUND CONNECTION FOR THE SERIES COMBINATION, TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS 5 AND 6 ON (M) UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE

Figure 7. Series Connection, LCS-C-01 thru LCS-C-05 Only, Common Load



NOTE
* MAKE ONLY ONE GROUND CONNECTION FOR THE SERIES COMBINATION; TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS 5 AND 6 ON (M) UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE

Figure 7A. Series Connection (Diodes Not Required For LCS-C-01 thru LCS-C-05), Dual Load

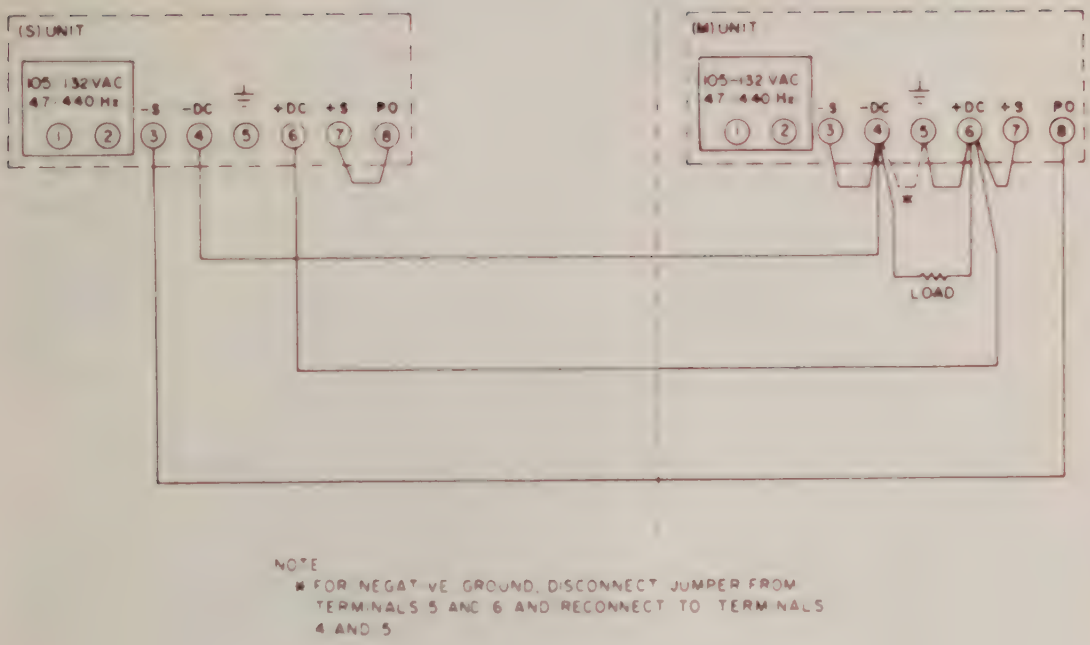


Figure 8. Parallel Connection, Local Sensing, LCS-C-01 — LCS-C-05 Only

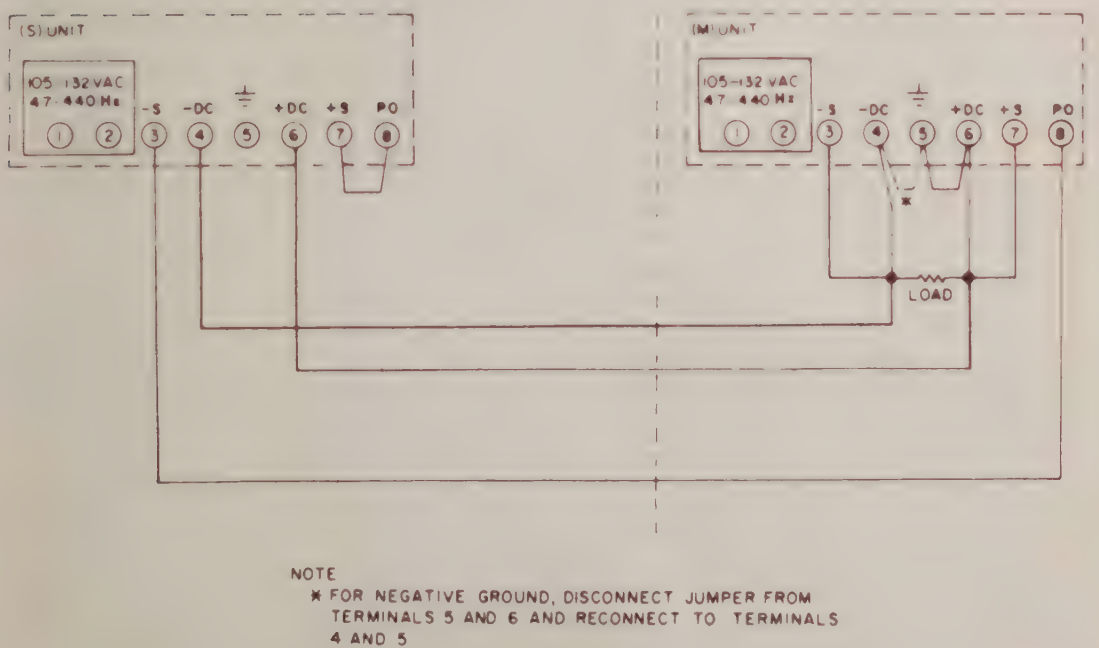
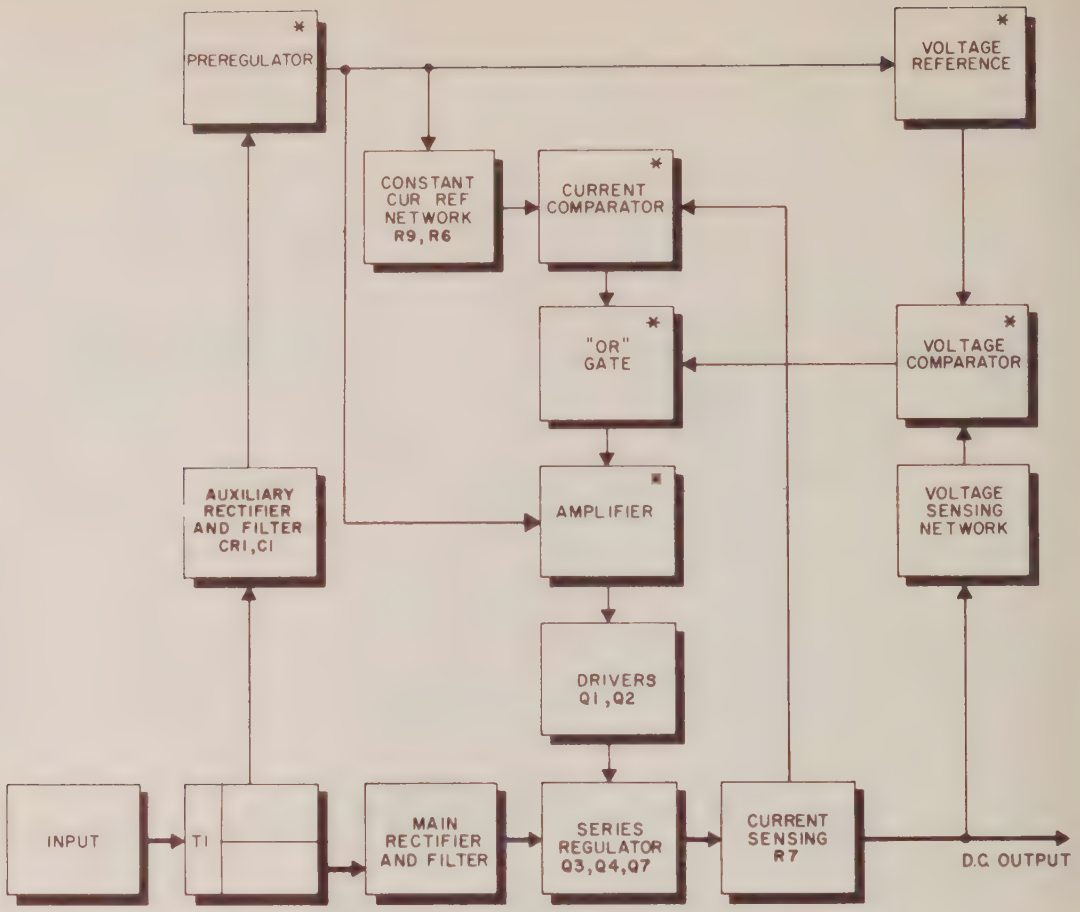
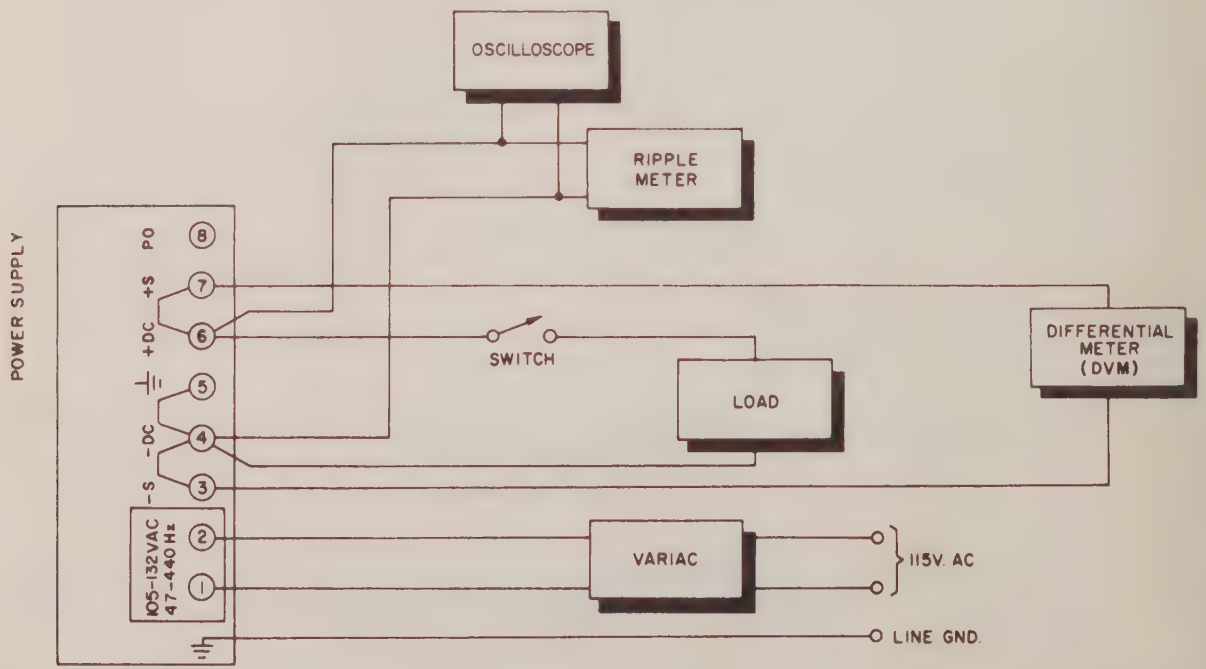


Figure 9. Parallel Connection, Remote Sensing, LCS-C-01 — LCS-C-05 Only



* THIS CIRCUIT ELEMENT IS LOCATED IN IC1.

Figure 10. Typical Block Diagram



NOTES:

1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.

Figure 11. Test Connections For Constant Voltage Performance Checks

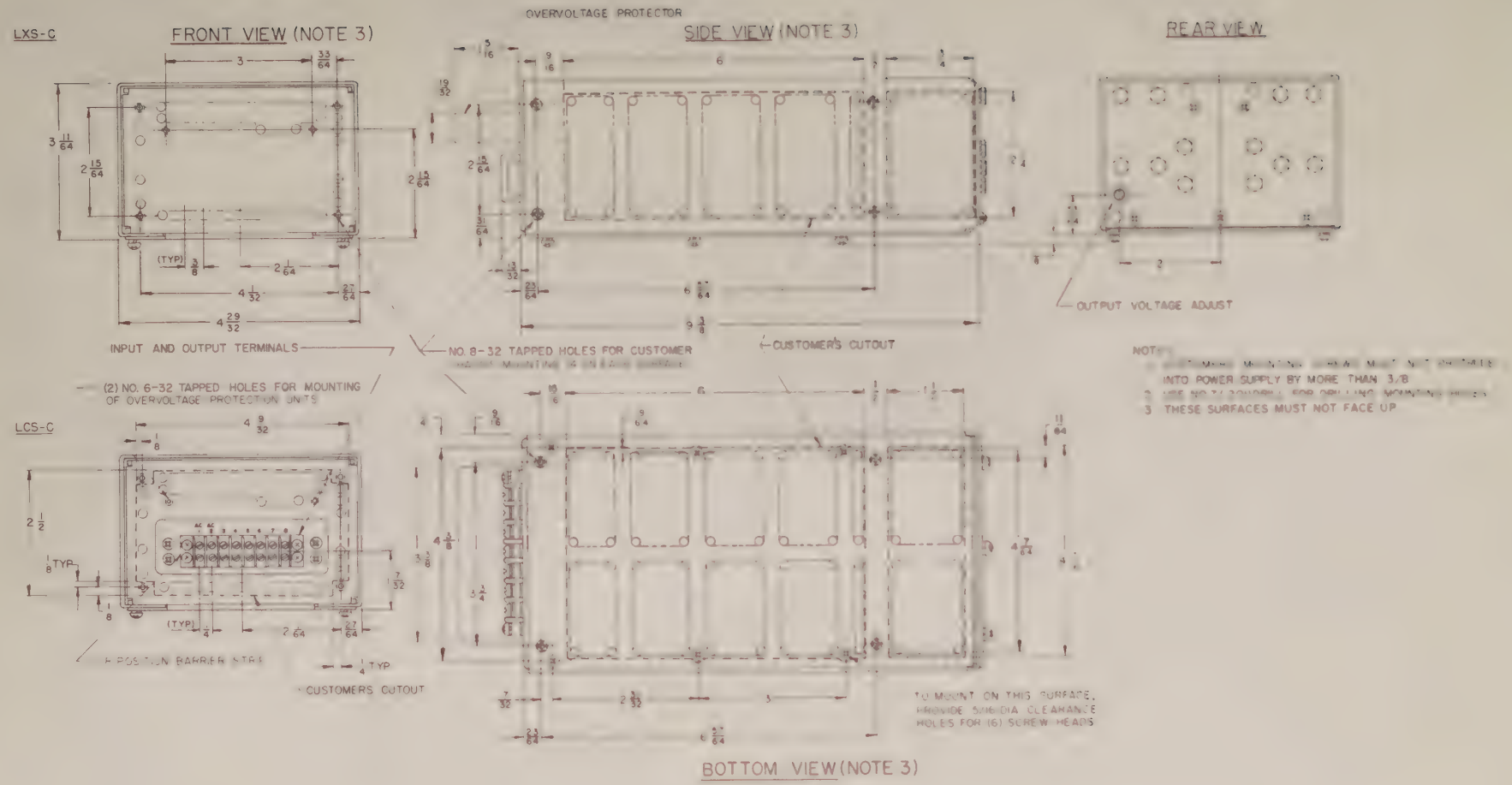
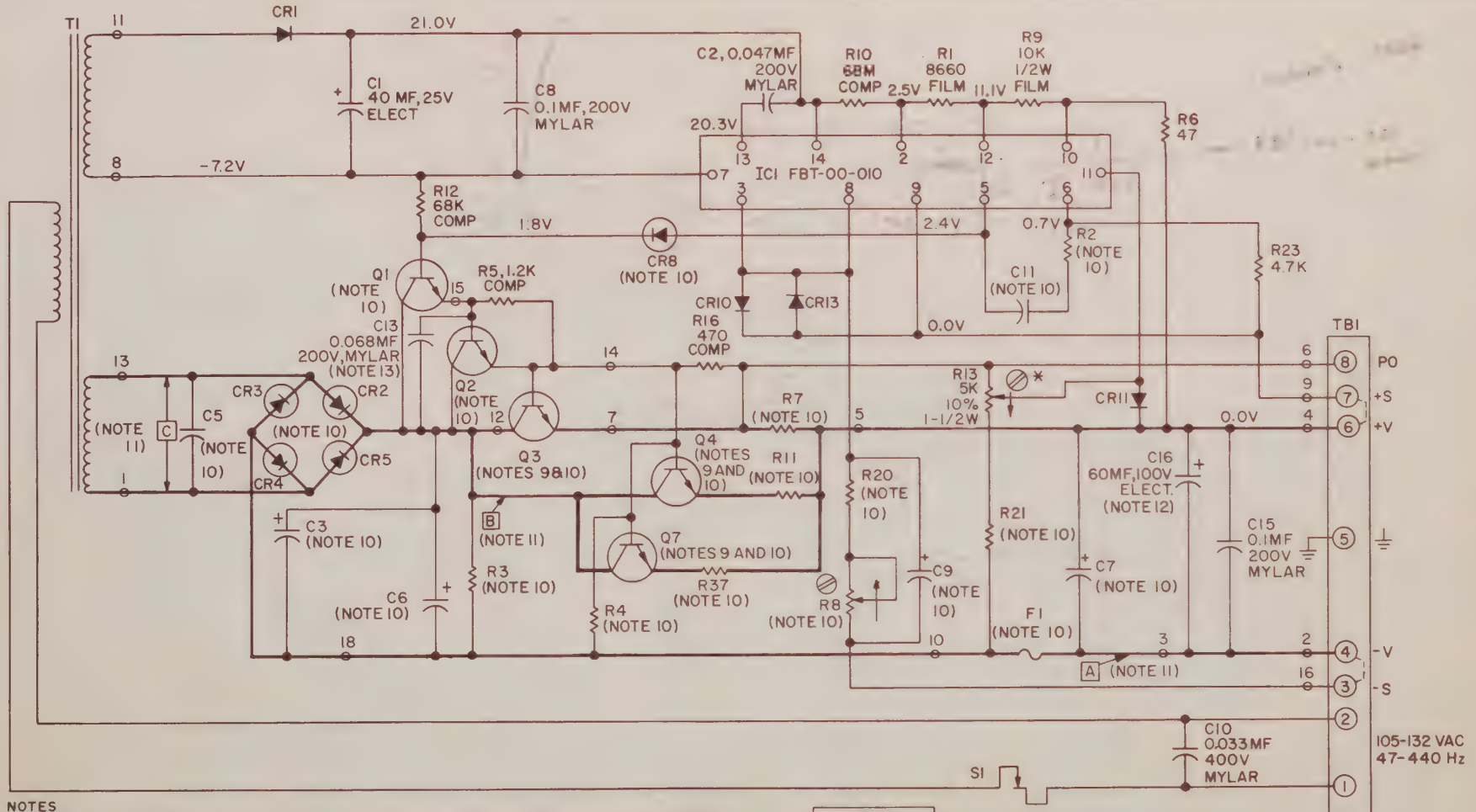

LXS-C
FRONT VIEW (NOTE 3)
OVERVOLTAGE PROTECTOR
SIDE VIEW (NOTE 3)
REAR VIEW
OUTPUT VOLTAGE ADJUST
INPUT AND OUTPUT TERMINALS
NO. 8-32 TAPPED HOLES FOR CUSTOMER
CUSTOMER'S CUTOUT
(2) NO. 6-32 TAPPED HOLES FOR MOUNTING OF OVERVOLTAGE PROTECTION UNITS
LCS-C
4 POSITION BARRIER STRIP
CUSTOMERS CUTOUT
INTO POWER SUPPLY BY MORE THAN 3/8
3 THESE SURFACES MUST NOT FACE UP
TO MOUNT ON THIS SURFACE, PROVIDE 5/16 DIA CLEARANCE HOLES FOR (6) SCREW HEADS
BOTTOM VIEW (NOTE 3)

Figure 12. Outline Drawing



NOTES

1. RESISTOR VALUES ARE IN OHMS
2. RESISTOR WATTAGE 1/4 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±2% FILM ±1%; UNLESS OTHERWISE NOTED
4. CAPACITOR TOLERANCES: ELECTROLYTIC -10%, +100%; MYLAR ±10%; CERAMIC 10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
   - INDICATES CLOCKWISE ROTATION OF SHAFT.
   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - SEE INSTRUCTION MANUAL.
   - LAMBDA PT. # FBL-00-030, USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD.
6. DESIGNATION IS LAMBDA PART NUMBER
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz, NOM. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED; +S AND +V SHORTED, -S AND -V SHORTED
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES
11. SEE TABLE I FOR VOLTAGE VALUES
12. C16 ONLY USED ON MODEL LCS-C-48.
13. C13 NOT USED ON MODELS LCS-C-100 THRU LCS-C-150.

MODELS
LCS-C-20
LCS-C-24
LCS-C-28
LCS-C-36
LCS-C-48
LCS-C-100
LCS-C-120
LCS-C-150

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO PREFIX A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS

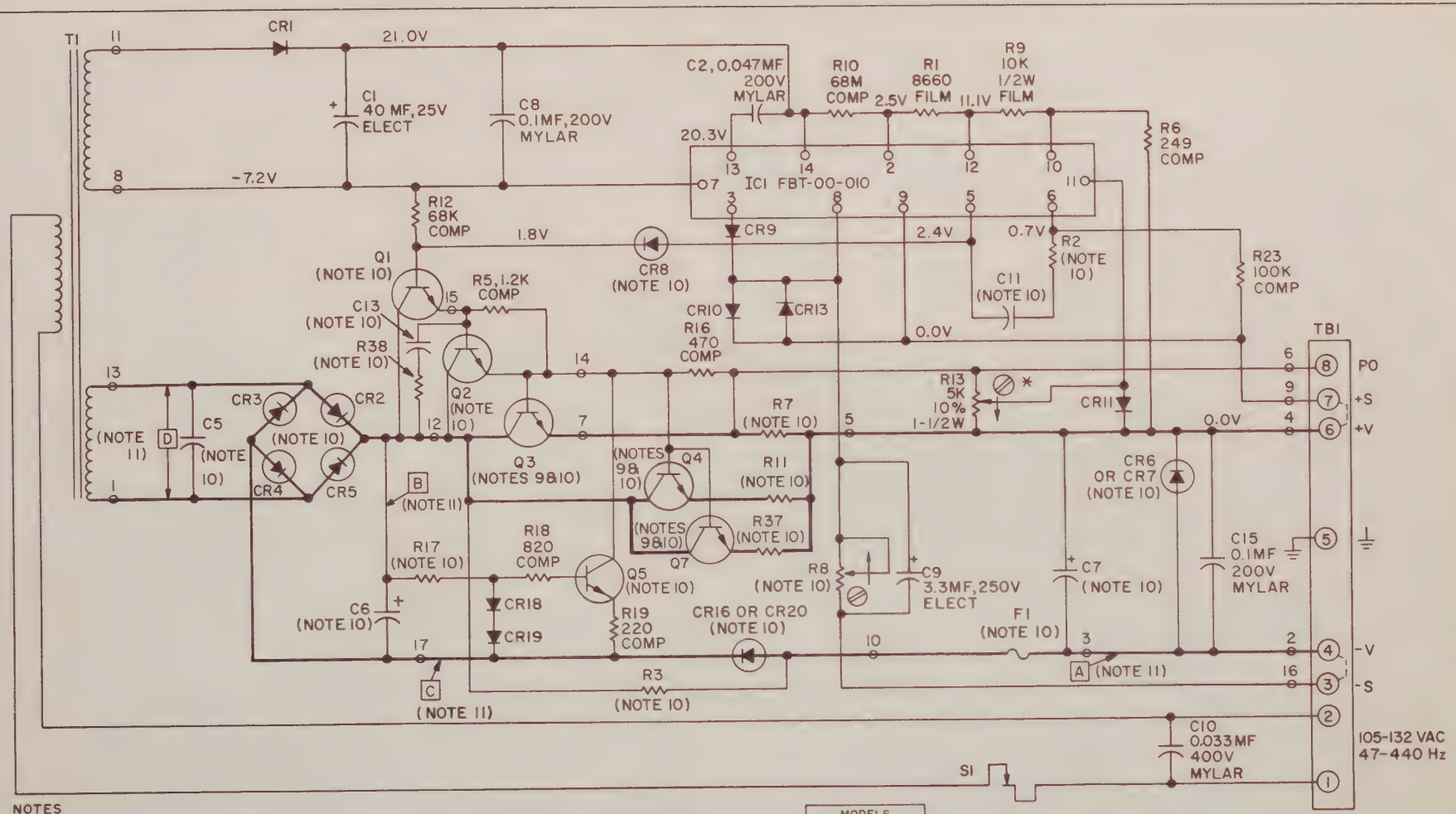
DOTTED CONNECTIONS INDICATE JUMPERS IN PLACE FOR LOCAL

LAMBDA
ELECTRONICS CORP.
MELVILLE, L.I., NEW YORK
A Veeco SUBSIDIARY

TABLE I
SCHEMATIC DATA REFERENCES
MODELS LCS-C-20 THRU LCS-C-150

Models	Schematic Voltage Measurements			Schematic Components																
	A (Vdc)	B (Vdc)	C (Vac)	C3, C6 -10 + 100% ELECT	C5 ±10% MYLAR	C7 -10 + 100% ELECT	C9 -10 + 100% ELECT	C11 ±10% 200V MYLAR	CR2-CR5 *FDH 06	CR6 *FDH 06	F1 AMPS	Q1 *FDN	Q2 *FDN	Q3 Q4 Q5 *FDN	R2 ±1% 1/4W COMP	R3 ±1% 2W COMP	R4	R7 R11 R15 3W WW	R8 ±1%	R20 1/2W FILM	R21 ±1% 1/4W FILM
LCS-C-20	-20	21.2	29.8	2700mf 50vdc	0.1mf 200vdc	300mf 50vdc	2mf 100vdc	0.0068mf	054	020	1	1109	8229	8229	330	10K	4.7K ±1% 1W COMP	0.39 ±5%	20K WW	15K ±2%	100K
LCS-C-24	-24	21.6	32.9	2700mf 50vdc	0.1mf 200vdc	300mf 50vdc	2mf 100vdc	0.0068mf	054	020	1	1109	8229	8229	330	10K	10K ±1% 1W COMP	0.39 ±5%	20K WW	15K ±2%	100K
LCS-C-28	-28	26.0	38.9	1600mf 60vdc	0.1mf 200vdc	300mf 50vdc	2mf 100vdc	0.0068mf	054	020	1	1109	8229	8229	470	15K	12K ±1% 1W COMP	0.50 ±5%	20K WW	24K ±5%	120K
LCS-C-36	-36	32.3	49.0	1100mf 75vdc (C3 not used)	0.1mf 200vdc	160mf 60vdc	2mf 100vdc	0.0068mf	054	020	1	1109	8047	8047	470	10K	12K ±1% 1W COMP	0.96 ±5%	23K CERMET	24K ±5%	120K
LCS-C-48	-48	45.7	66.9	400mf 100vdc	0.1mf 200vdc	60mf 100vdc	2mf 100vdc	0.0068mf	054	020	1	1109	8229	8229	470	27K	12K ±1% 3W WW	1.50 ±2%	23K CERMET	39K ±5%	200K
LCS-C-100	-100	60.0	113	240mf 200vdc (C3 not used)	0.033mf 400vdc	39mf 200vdc	3.3mf 250vdc	0.0022mf	033	033	5	1115	8221	8229	220	100K	40K ±1% 5W WW	2.3 ±2%	75K CERMET	91K ±5%	432K 1/2W
LCS-C-120	-120	61.0	129	240mf 200vdc (C3 not used)	0.033mf 400vdc	39mf 200vdc	3.3mf 250vdc	0.0022mf	033	033	1 1/2	1115	8221	8229	220	100K	40K ±1% 5W WW	2.7 ±2%	75K CERMET	91K ±5%	432K 1/2W
LCS-C-150	-150	75.0	160	200mf 250mf (C3 not used)	0.033mf 400vdc	30mf 250vdc	3.3mf 250vdc	0.0022mf	033	033	1 1/2	1115	8221	8229	220	100K	40K ±1% 5W WW	3.5 ±2%	75K CERMET	120 ±1%	432K 1/2W

*Lambda part number



NOTES

1. RESISTOR VALUES ARE IN OHMS.
2. RESISTOR WATTAGE 1/4 WATT; RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES: COMP. ±10%; WIREWOUND ±2% FILM ±1%; UNLESS OTHERWISE NOTED.
4. CAPACITOR TOLERANCES ELECTROLYTIC -10%, +100%, MYLAR ±10%; CERAMIC 10%; UNLESS OTHERWISE NOTED.
5. SYMBOLS:
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   - INDICATES CONNECTION TO CHASSIS.
   - INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
   - * SEE INSTRUCTION MANUAL.
   - LAMBDA PT #FBL-00-030, USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD.
6. DESIGNATION IS LAMBDA PART NUMBER
7. DERATE CURRENT 10% FOR 47-57Hz, FOR 63-440Hz CONSULT FACTORY.
8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz; MAX. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED; +S AND +V SHORTED, -S AND -V SHORTED
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES.
11. SEE TABLE I FOR VOLTAGE VALUES.
12. NOT USED ON MODEL LCS-C-05.

MODELS
LCS-C-04
LCS-C-05

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO PREFIX A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS

DOTTED CONNECTIONS INDICATE JUMPERS IN PLACE FOR LOCAL SENSING "2-WIRE CONNECTION"

LAMBDA

ELECTRONICS CORP

MELVILLE, L.I., NEW YORK

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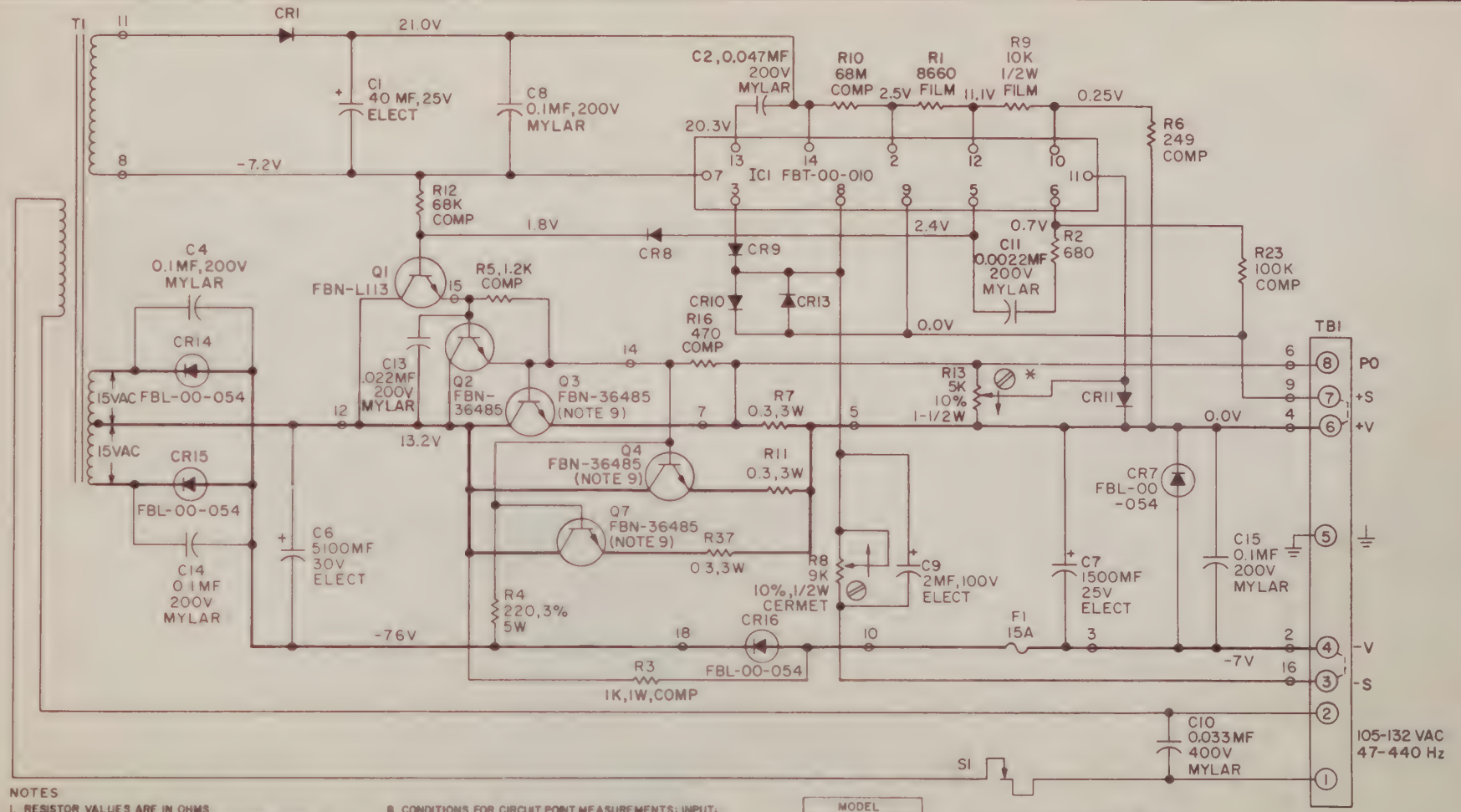

NOTES

1. RESISTOR VALUES ARE IN OHMS
2. RESISTOR WATTAGE 1/4 WATT, RESISTORS ABOVE 2 WATTS ARE WIREWOUND UNLESS OTHERWISE NOTED
3. RESISTOR TOLERANCES COMP ±10%, WIREWOUND ±5% FILM ±1%, UNLESS OTHERWISE NOTED
4. CAPACITOR TOLERANCES ELECTROLYTIC -10%, +100%, MYLAR ±10%, CERAMIC 10%, UNLESS OTHERWISE NOTED.
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9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.

MODEL
LCS-C-01

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO PREFIX A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS

DOTTED CONNECTIONS INDICATE JUMPERS IN PLACE FOR LOCAL SENSING "2-WIRE CONNECTION"

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MELVILLE, L.I., NEW YORK
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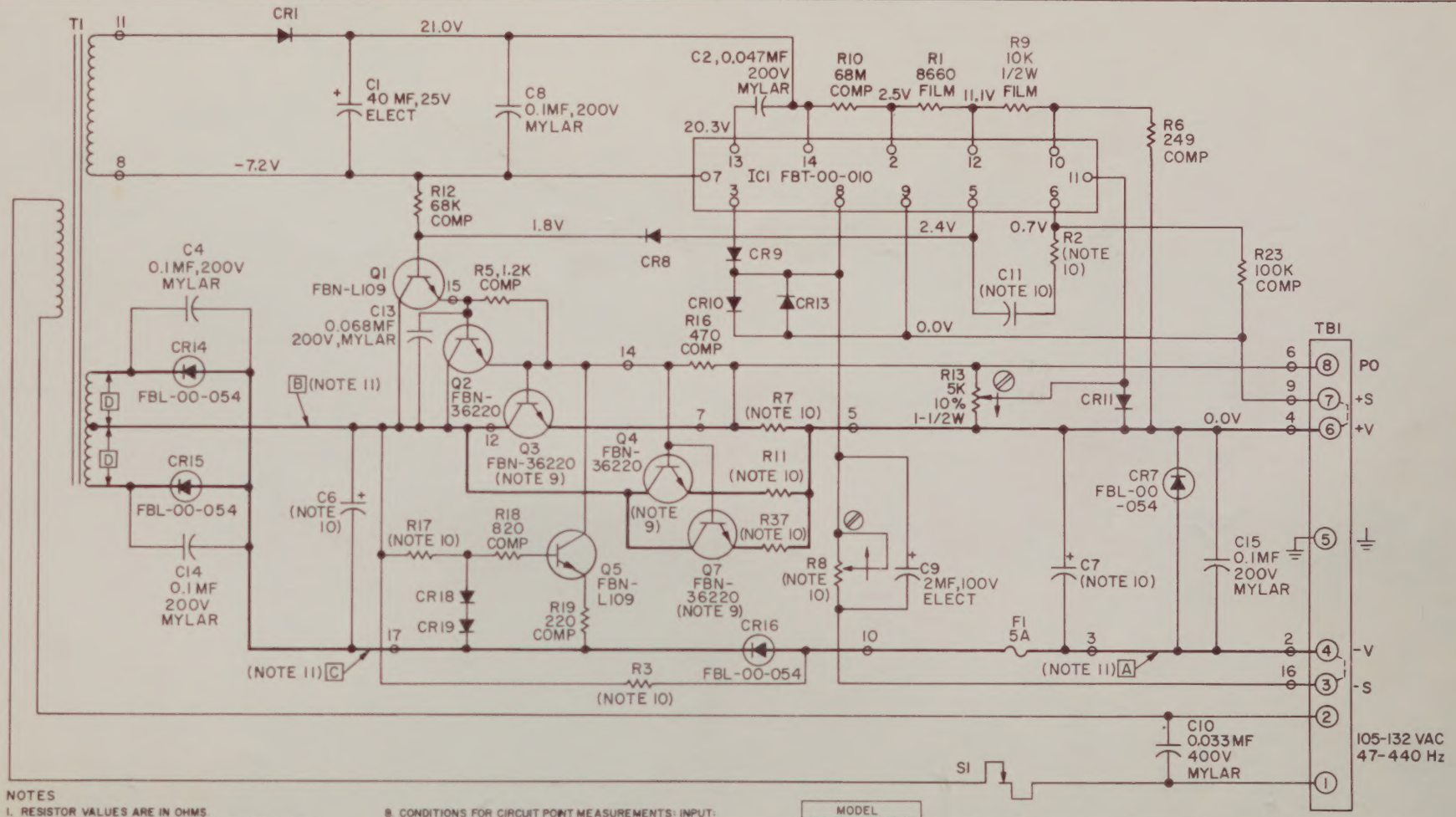
TABLE I
SCHEMATIC DATA REFERENCES
MODELS LCS-C-02, LCS-C-03

Model	Schematic Voltage Measurements				Schematic Components						
					C6	C7	C11	R2	R3, R17	R7, R11, R37	R8
	A (Vdc)	B (Vdc)	C (Vdc)	D (Vac)	-10 + 100% ELECT	-10 + 100% ELECT	±10%, 200V MYLAR	±10%, 1/4W COMP	1W COMP	3W WW	±10% CERMET
LCS-C-02	-18	17	-18.6	25.5	2700mf 50vdc	280mf 40vdc	0.0068mf	470	3.3K ±5%	0.66 ±5%	23K
LCS-C-03	-32	26	-32.6	41.9	1100mf 75vdc	175mf 50vdc	0.0022mf	330	10K ±10%	0.88 ±2%	40K



NOTES

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   - * SEE INSTRUCTION MANUAL.
   - ▶| LAMBDA PT.#FBL-00-030, USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
   - INDICATES TERMINAL ON PRINTED WIRING BOARD.
6. DESIGNATION IS LAMBDA PART NUMBER.
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8. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60Hz; MAX. RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN +S (TERM. 7) & INDICATED POINTS UNLESS NOTED; +S AND +V SHORTED, -S AND -V SHORTED.
9. COAT BOTH SIDES OF INSULATING WAFER WITH DOW CORNING NO. 340 SILICONE GREASE.
10. SEE TABLE I FOR COMPONENT VALUES.
11. SEE TABLE I FOR VOLTAGE VALUES.

MODEL
LCS-C-02
LCS-C-03

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIX A

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO POWER SUPPLY-TO-LOAD WIRING DIAGRAMS

DOTTED CONNECTIONS INDICATE JUMPERS IN PLACE FOR LOCAL SENSING "2-WIRE CONNECTION"

LAMBDA

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MELVILLE, L.I., NEW YORK

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TABLE I
SCHEMATIC DATA REFERENCES
MODELS LCS-C-04, LCS-C-05

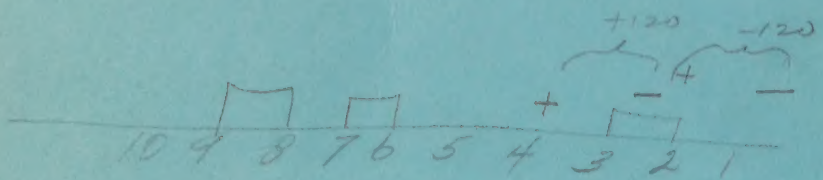
Model	Schematic Voltage Measurements				Schematic Components																
	A (Vdc)	B (Vdc)	C (Vdc)	D (Vac)	C5	C6	C7	C11	C13	CR2-CR5	CR6,CR20	CR7,CR16	CR8	F1	Q1,Q5	Q2	Q3,Q4,Q7	R2	R3,R17	R7,R11,R37	R8	R38
					±10% MYLAR	-10 + 100% ELECT.	-10 + 100% ELECT.	200vdc MYLAR	200vdc MYLAR	*FBL-00-	*FBL-00-	*FBL-00-	*FBL-00-	(AMPS)	*FBN-	*FBN-	*FBN-	±10%, 1/4W COMP	±10%, 1W COMP	±2%,3W WW	±10% CERMET	±10%, 1/4W COMP
LCS-C-04	-60	33.2	-60.6	67	0.1mf 200vdc	240mf 200vdc	60mf 100vdc	0.0068mf	0.068mf	054	Not used	054	036	5	L108	35902	35902	220	27K	1.82	75K	JUMPER
LCS-C-05	-120	38	-120.6	113	0.033mf 400vdc	400mf 100vdc	30mf 250vdc	0.0022mf	0.022mf	033	033	Not used	033	1-1/2	L115	38021	38982	220	100K	4.36	150K	10

*Lambda part number

5-Year Guarantee

We warrant each instrument manufactured by us, and sold by us or our authorized agents, to be free from defects in material and workmanship, and that it will perform within applicable specifications for a period of five years after original shipment. Our obligation under this guarantee is limited to repairing or replacing any instrument or part thereof, (except tubes and fuses) which shall, within five years after delivery to the original purchaser, be returned to us with transportation charges prepaid, prove after our examination to be thus defective.

We reserve the right to discontinue instruments without notice, and to make modifications in design at any time without incurring any obligation to make such modifications to instruments previously sold.



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